



**US Army Corps
of Engineers®**



Limited Visual Dam Safety Inspections

OA00124

Kaneohe Dam

Oahu, Hawaii

Prepared by:

**U.S. ARMY CORPS OF ENGINEERS
HONOLULU DISTRICT**

**STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES**

May 2006

Dam ID: HI000124

Name: Kaneohe Dam

Limited Visual Dam Safety Inspection Conducted on: 03 April 2006

I. Purpose:

Due to disaster occurrences of periodic heavy rains and flooding, which has caused extensive damage to property and loss of lives, the Governor has issued a State of Emergency Proclamation extending from February 20, 2006 to April 9, 2006. In light of the tragic failure of the Kaloko dam on Kauai and the continued forecast of heavy rains, emergency inspections of all regulated dams in all counties are being undertaken.

These inspections are for the purpose of determining if any of the regulated dams and reservoirs in the City and County of Honolulu, Maui County or Hawaii County, are suspect for immediate concern to the downstream area under the prolonged conditions of heavy rain showers.

II. Authority

Inspections were authorized under the Hawaii Dam Safety Act of 1987, Chapter 179D "Dams and Reservoirs" of Hawaii Revised Statutes, and Title 13, Subtitle 7, Chapter 190, "Dams and Reservoirs" of the Hawaii Administrative Rules.

These inspections were conducted under joint agreements of the U.S. Army Corps of Engineers (ACE), the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), and the State of Hawaii. The Memorandum of Agreement with the U.S. Army Corps of Engineers is entered into pursuant to 10 U.S.C. § 3036(d)(2), and the Intergovernmental Cooperation Act (31 U.S.C. §6505), and established via support agreement number DL-06-01.

III. Scope

Visual inspection was performed on parts of the embankment and appurtenant works readily available and visible for inspection by the inspection team at the time of the inspection. Such parts and appurtenant works included the upstream slope, crest, downstream slope, abutments and toes, outlet works, and spillway.

On the date of this limited visual inspection, there may or may not have appeared to be any immediate threat to the safety of the dam, however no assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

IV. Limitations of Findings and Recommendations

The inspection is based only on visible features/areas of the dam on the day of inspection. The inspection does not entail detailed stability, hydrologic, hydraulic, or seismic investigations. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies.

V. Inspection Team

Organization

U.S. Army Corps of Engineers
 State of Hawaii, Dept. of Land and Natural Resources
 National Resource Conservation Service

Name

Mr. Troy Cosgrove
 Mr. Hiram Young
 Mr. Doug Toews

VI. Owner's Representatives Present

Mr. Gary Ikeda, City and County of Honolulu, Department of Facility Maintenance

VII. Inspection Team

Organization

U.S. Army Corps of Engineers

 State of Hawaii, Dept. of Land and Natural Resources

Name

Mr. Derek Chow
 Mr. Joseph Koester
 Ms. Denise Manuel
 Mr. Edwin Matsuda

VIII. Dam Type

The dam is an earthen embankment.

IX. Dam Classification

The current hazard classification of this dam is: High

Based on available data, this classification is believed to still be applicable.

Hazard Potential Classification based on the following:

| Category | Loss of Life | Economic Loss |
|-------------|--|---|
| Low | None Expected | Minimal (undeveloped to occasional structures or agriculture) |
| Significant | Few (No Urban development and no more than a small number of inhabitable structures) | Appreciable (Notable agriculture, industry or structures) |
| High | More than a few | Extensive community, industry or agriculture. |

Based on inventoried storage / height data, the dam size classification is: Intermediate

Size Classification based on the following:

| Category | Storage (Acre-Feet) | Height (feet) |
|--------------|---------------------|----------------|
| Small | < 1000 | < 40 |
| Intermediate | > 1000 and < 50,000 | > 40 and < 100 |
| Large | > 50,000 | > 100 |

X. Summary of Inspection:

Condition Rating Criteria: The conditional terms in this report are used to generally describe the conditions below. Inspections, monitoring, and additional investigations are considered to be incidental to all condition ratings.

| | |
|----------------|---|
| Satisfactory | Expected to fulfill intended function. |
| Fair | Expected to fulfill intended function, but maintenance is recommended. |
| Poor | May not fulfill intended function; maintenance or repairs are necessary. |
| Unsatisfactory | Is not expected to fulfill intended function; repair, replacement, or modification is necessary. |
| Unknown | Not visible, not accessible, not inspected, or unable to determine the condition rating based on the observation taken. |

A. General appearance:

The reservoir and dam features were easily recognizable. This dam is well maintained with no over growth of vegetation.

Modifications / Improvements: There were no signs of any recent modifications. The reservoir appeared to have a significant drainage area. Based on staff personnel, this reservoir has no incident history.

Findings and Corrective Actions:

- a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
- b. An EAP is required for all High Hazard Dams. Submit an updated EAP for this facility.
- c. Routine inspection logs were not inspected.
- d. Dam owners shall provide for routine inspection of the dam.
- e. Access to dam is questionable during severe weather conditions and/or spillway overflows. Operational plans and emergency plans need to reflect this deficiency or access provided.
- f. Submit current Operations and Maintenance Manual or Procedures for this dam/reservoir facility.
- g. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
- h. Emergency Alarms / Monitors: There were no alarms or monitors observed on this reservoir.
- i. Power / Communication: There were no communication systems observed on this reservoir. There were no utility or power poles visible nearby.

B. Access / Security:

A four wheel drive vehicle is not required. Access to dam is questionable during severe weather conditions. Operational plans need to reflect this deficiency or access improved.

Access to the dam is via several locked gates.

C. Inflow Works:

This dam is fed by surface water and no intakes were noted.

D. Reservoir

The reservoir level during the inspection was elevation 160.5 ft per the gage.

A staff gage was observed near the outlet works intake structure.

The intake is not gated and is normally empty or low.

Findings and Corrective Actions:

- a. The reservoir was not inspected and only observed from the intake structure of the outlet works.
- b. The reservoir appeared to be in fair to poor condition and requires corrective action.
- c. Trees have been planted by the Botanical Gardens near the intake for the outlet works. These should be removed to reduce the debris from entering the intake.

E. Upstream Slope (Satisfactory)

The typical upstream slope was +/- 1V:2H (Vertical / Horizontal).

There was no slope protection observed other than low grass.

Erosions was not observed.

Cracks were not observed.

Sinkholes were not observed.

Findings and Corrective Actions:

- a. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.

F. Crest: (Satisfactory)

The dam crest was approximately 15 feet wide

There was a dirt access road on top of the crest which appeared to be well utilized.

Vegetation was observed on the edges of the crest. These were primarily low grass.

Findings and Corrective Actions:

- a. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.
- b. Access along the crest was satisfactory.

G. Downstream Slope: (Satisfactory)

The downstream slope was in good condition with the exception of some areas with little vegetation, loose soil and small ruts on the downstream left side of the dam.

The slope was around 1V to 2H.

There was access to the downstream slope and a roadway along the downstream toe. There was no slope protection observed on the downstream slope.

Findings and Corrective Actions:

- a. The downstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
- b. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: Fill, compact and regrade ruts. Low grass should be established to reduce erosion.

H. Abutments / Toe: (Fair)

The abutments and toe were entirely visible and identifiable.

Erosion along the abutment or toe was not observed.

An area was noted along the toe that could be a possible seepage spot. This location was observed near the right side of the outlet works. The water that was seeping appeared to be moving relatively slow and was clear.

Findings and Corrective Actions:

- a. The abutments/toe appeared to be in satisfactory condition, no corrective actions are required at this time.
- b. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.

I. Outlet Works: (Satisfactory)

The outlet works appeared to be a 5' by 10' box culvert.

The outlet works was uncontrolled.

Findings and Corrective Actions:

- a. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.

J. Spillway: (Satisfactory)

This spillway consisted of a grass covered channel that transitioned into a riprap channel and then into a concrete channel with an ogee weir.

The rough dimension was 60 ft wide at the crest.

The spillway channel feeds into the downstream channel just downstream of the outlet works.

The spillway approach contained some vegetation

There was no erosion observed near the spillway.

The vegetation appears to be bushes, tall grass, and woody vegetation.

Dam ID: HI000124

Name: Kaneohe Dam

Findings and Corrective Actions:

- a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.
- b. Trees are unacceptable in the spillway channel and approach. Take corrective action to address the woody vegetation problem and repair the damaged area.
- c. Clear vegetation near spillway entrance.

K. Down Stream Channel: (Unknown)

The down stream channel was not investigated.

If the dam were to fail, the resulting flood wave would probably enter Kamooalii Stream. There is a well defined downstream channel.

This reservoir is considered to have a high hazard potential.

Findings and Corrective Actions:

- a. The downstream channel was not inspected.
- b. Near dam outlet works, the downstream channel appeared to be in satisfactory conditions, no corrective actions are required at the time.

XI. Additional Comments:

Original field inspection notes were scanned and are attached to this summary report. Included are several photos from the site visit to detail important features of the project, captioned to be self-explanatory.

Per e-mail dated 5/2/2006 5:16 am from Troy Cosgrove

Downstream Slope:

Please indicate your findings. Satisfactory, poor, unsatisfactory. **Satisfactory**

Outlet Works:

Control on upstream, control on downstream **Uncontrolled drop structure.**

Comments:

The dam did not present a safety hazard at the time of inspection.

The spillway vegetation should be removed when possible and the seepage should be monitored and its source determined. A geotechnical engineer should be retained to assist with the seepage determination.

PHOTOGRAPHS

Dam ID: HI000124

Name: Kaneohe Dam



Photo 1 Intake for outlet works.



Photo 2 Upstream toe.

Dam ID: HI000124

Name: Kaneohe Dam



Photo 3 Upstream slope.



Photo 4 Entrance to spillway.

Dam ID: HI000124

Name: Kaneohe Dam



Photo 5 Trees along spillway slope.



Photo 6 Outlet works.

Dam ID: HI000124

Name: Kaneohe Dam



Photo 7 Seepage near outlet works.



Photo 8 Downstream erosion channels.

Dam ID: HI000124

Name: Kaneohe Dam



Photo 9 Crest

FIELD INSPECTION SHEETS

Dam ID: OA-0124KANEOHE DAM**Vulnerability Index:**

| | | | |
|---------|------|----------|-----|
| Extreme | High | Moderate | Low |
| 1 | 2 | 3 | 4 |

Inspection No: _____

Date: 4/3/06

STATE OF HAWAII - DLNR
DAM SAFETY INSPECTION SHEET

Inspection Type: Visual Dam Safety Inspection**Persons Present**Troy CasgrveGary IkedaDoug ToewsHiram Young**Affiliation**US Army Corps of EngineersCard C Honolulu PPWNRCSDLNR**Phone Number****Weather Condition:**
☒ Rain previous day
 ☐ Rainy
 ☐ Drizzle / Mist
 ☐ Cloudy/Overcast
 ☐ Partly Cloudy
 ☒ Sunny
 ☐ Dry

Comments: _____

1. General: (Information currently on file, update as required)Dam/Res. Name KANEOHE DAMOwner City & County of Honolulu, Dept. of Facility Maintenance(C004)Owner Contact Mr. Tyler Sugihara

Owner Ph. _____

Lessee N/A

Lessee Ph. _____

O & M Contractor Owner

O & M Ph. _____

Nearest Town KANEOHELatitude 21.395° (decimal)County HONOLULULongitude 157.8067° (decimal)Tax Map Key(s) (1)4-5-041:009Dam Status A:Hazard Potential H:

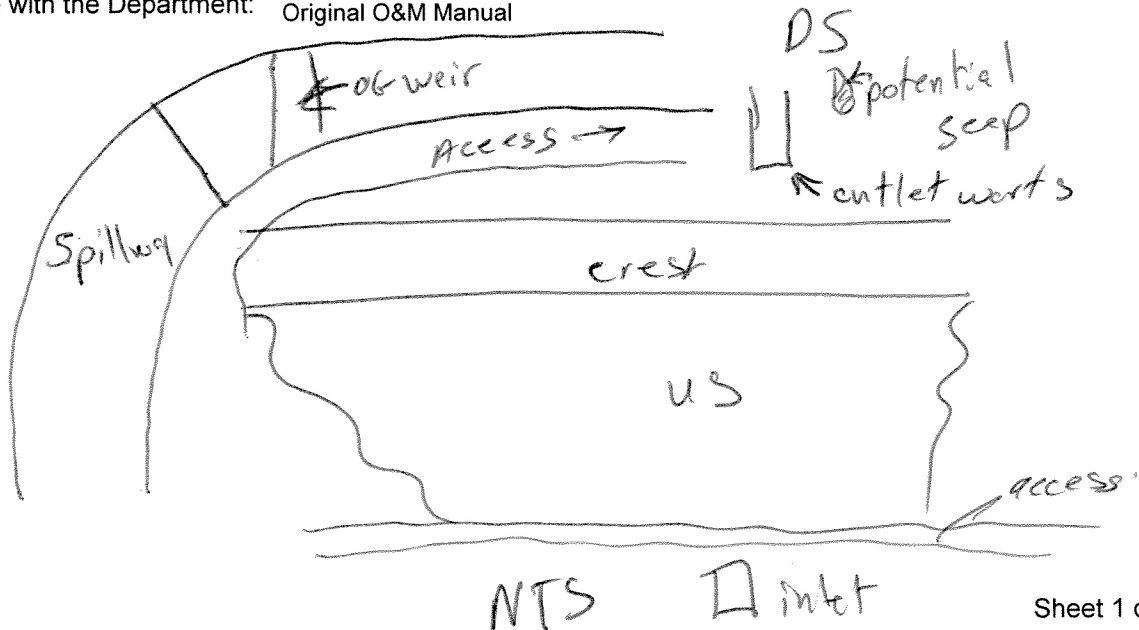
Dam Size _____

Year Completed 1980Dam Length 2200 ft.Dam Height 76 ft.Normal Storage 260 ac.ft.Max. Storage 4500 ac.ft.Max. Surface Area 26 ac.Drainage Area 3 mi.

Spillway Type _____

Max. Spillway Q 15000 cfs

Owner owns land under dam facility: _____

Emergency Action Plan on file with the Department: YESReports on file with the Department: Original O&M Manual

Dam ID: OA-0124KANEOHE DAM

Inspection No: _____

Date: 4/13/06**2. Questions for Owner's Rep.:**

Yes No Unknown Comments

| | | | | |
|---------------------------------|-------------------------------------|-------------------------------------|--------------------------|--|
| Construction Plans Available | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| Site / Facility Map | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| Operation & Maintenance Manual | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| Emergency Action Plan | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| Modifications / Improvements | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | _____ |
| Conduct Routine Inspections | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| Conduct Routine Maintenance | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | _____ |
| Vehicle access to site | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> Not accessible <input checked="" type="checkbox"/> With Standard car <input type="checkbox"/> Requires 4-Wheel Drive |
| Access during heavy rains | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> Not accessible <input checked="" type="checkbox"/> With Standard car <input type="checkbox"/> Requires 4-Wheel Drive |
| Access when spillway is flowing | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> Not accessible <input type="checkbox"/> With Standard car <input type="checkbox"/> Requires 4-Wheel Drive |
| Other Studies Conducted | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> Phase I <input type="checkbox"/> Phase II <input type="checkbox"/> Hydraulics <input type="checkbox"/> Stability <input type="checkbox"/> Hazard <input type="checkbox"/> Seismic <input type="checkbox"/> Other: _____ |
| Incident History | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> Breached <input type="checkbox"/> Overtop <input type="checkbox"/> Slide <input type="checkbox"/> Down stream Flooding <input type="checkbox"/> Other: _____ |
| Reservoir's Current Use | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> Sediment <input type="checkbox"/> Irrigation <input type="checkbox"/> Recreation <input checked="" type="checkbox"/> Flood Control <input type="checkbox"/> Drinking Water <input type="checkbox"/> Power Generation <input type="checkbox"/> Other: _____ |

Findings and Corrective Actions:

- ☒ a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility. 4/23/06
- ☐ b. An Emergency Action Plan (EAP) is on file with the department, submit any updates as applicable.
- ☒ c. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility. 4/23/06
- ☐ d. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
- ☐ e. Submit narrative and additional information detailing the improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
- ☒ f. Routine inspection logs were not inspected.
- ☒ g. Dam owners shall provide for routine inspection of the dam. 4/23/06
- ☐ h. The dam did not appear to be maintained on a regular basis.
- ☐ i. Access to site appears to be satisfactory.
- ☐ j. There is no vehicular access to the dam site. Operational and emergency plans need to reflect this deficiency or access provided.
- ☒ k. Access to dam is questionable during severe weather conditions and/or spillway overflows. Operational plans and emergency plans need to reflect this deficiency or access provided.
- ☐ l. Provide a detailed narrative of the incident, responses taken, and any damages incurred. Dam owners are required to promptly advise the department of any sudden or unprecedented flood or unusual or alarming circumstance or occurrences which may adversely affect the dam or reservoir.
- ☒ m. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility. 4/23/06
- ☒ n. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits. 4/23/06
- ☐ o. _____

Additional Requirements:

The following investigative study(s) are:

Required Recommended

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Phase I Study |
| <input type="checkbox"/> | <input type="checkbox"/> | Phase II Study (Including <input type="checkbox"/> Seepage <input type="checkbox"/> Hydrology/Hydraulics <input type="checkbox"/> EAP) |
| <input type="checkbox"/> | <input type="checkbox"/> | Hydrology and Hydraulics (including Probable Maximum Flood and spillway capacity) |
| <input type="checkbox"/> | <input type="checkbox"/> | Stability Analysis |
| <input type="checkbox"/> | <input type="checkbox"/> | Seismic Analysis |
| <input type="checkbox"/> | <input type="checkbox"/> | Hazard Classification |
| <input type="checkbox"/> | <input type="checkbox"/> | Other: _____ |

Dam ID: OA-0124

KANEOHE DAM

Inspection No: _____

Date: 4/3/06

Physical Dam Features: (Check All Applicable. Provide description of Items Observed and/or Take Photos. Indicate photo # in description.)

3. Reservoir:

Level during inspection 160.5 ft per gagc (gage / other)

Normal Operating Level/Range _____ ft per _____ (gage / other)

Description: _____

Typical Operation ☐ Spillway always flowing ☐ Kept within normal range ☐ Kept Empty ☐ Drained Daily ☒ Only filled by Storms

☐ Other: _____

Sinkhole in Res.: ☐ # Observed: _____ Size: _____ by _____ in. Deep ☒ Not Visible ☒ None Observed

Description: _____

Staff Gage: Description: Elevation staff gage on intake structure

Findings:

- ☒ a. The reservoir was not inspected. only inspected near intake structure of outlet works.
- ☐ b. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☒ c. The reservoir appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The reservoir appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

- ☐ e. The staff gage needs maintenance and/or repair. Description: _____
- ☐ f. A staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir.
- ☐ g. A sinkhole was observed in the upstream reservoir. Conduct additional investigations and monitoring to identify the cause, risk and appropriate action.
- ☒ h. Trees have been planted by Botanical Gardens near intake for outlet work
This should be removed to reduce debris entering intake.

4. Intake Works Description:

☐ Number of Intakes _____

☐ Intake Culvert / Pipe

Size: _____ in. ☐ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____

Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or Bypassed

From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other _____

☐ Ditch / Flume

Dimension: _____ (Size x Depth) Shape _____

Surface: ☐ Dirt ☐ Wood ☐ Concrete ☐ Lined w/ _____

Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or Bypassed

From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other _____

Findings:

- ☐ a. The intake works were not inspected.
- ☐ b. The intake works were not tested.
- ☐ c. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ d. The intake works appeared to be in fair to poor condition and requires corrective action.
- ☐ e. The intake works appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

- ☐ f. The intake works needs maintenance and/or repair. Description: _____
- ☐ g. _____

Dam ID: OA-0124

KANEOHE DAM

Inspection No: _____

Date: 4/3/06

5. Upstream Slope:

(Typical Slope \pm 1V: 2H)

Slope Protection: ☒ None ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Liner _____ ☒ Other: grass

☐ Defect in Protection: Description: _____

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☒ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: _____

Sinkholes: ☐ # Observed: _____ Size: _____ and _____ Depth ☐ Not Visible ☒ None Observed

Description: _____

Vegetation: ☐ None ☒ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees # _____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: _____

Findings:

- ☐ a. The upstream slope was not inspected.
- ☒ b. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The upstream slope appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The upstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Slope protection needs maintenance or repair. Description: _____
- ☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____
- ☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ i. The upstream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ j. Tree(s) were observed on the dam embankment. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ k. _____

Dam ID: OA-0124
KANEOHE DAM

Inspection No: _____
Date: 4/3/06

6. Crest:

Approximate Crest Width: 15 ft

Access: ☐ None ☐ Walking Path ☒ Roadway, Surface / Width / Usage: Site Access

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☒ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☒ None Observed

Description: _____

Vegetation: ☐ None ☒ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees # _____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: Gravel Cover and gravel roadway

Findings:

- ☐ a. The dam crest was not inspected.
- ☒ b. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The dam crest appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The dam crest appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☒ e. Access along the crest was satisfactory.
- ☐ f. Access along the crest was not possible. Description: _____
- ☐ g. Rut and/or Gully erosion was observed on the crest, which requires maintenance and/or repair. Description: _____
- ☐ h. A crack was observed on the crest, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ i. A sinkhole was observed on the crest, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ j. Portions of the crest were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ k. Tree(s) were observed along the dam crest. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ l. _____

Dam ID: OA-0124

KANEOHE DAM

Inspection No: _____

Date: 4/3/06

7. Downstream Slope:

(Typical Slope \pm 1V : 2H)

Access: ☐ lower roadway along toe ☒ roadway to outlet works ☐ walkway to outlet works ☐ None Observed

Slope Protection: ☒ None ☐ Dumped Rock ☒ Rip Rap ☐ Grouted Rip Rap ☐ Concrete (Riprap near toe of slope)

Erosion: ☒ Loose soil w/ little vegetation ☒ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☐ None Observed

Description: Some areas with little vegetation and loose soil. Some Ruts DS left side

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☒ None Observed

Description: _____

Vegetation: ☐ None ☒ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees # _____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: _____

Seepage: Seep Spot Number 1

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed

☒ Flowing, Description: Sparse Seepage DS Right side of outlet works, possible runoff

Water Clarity: ☒ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Seep Spot Number 2

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

- ☐ a. The downstream slope was not inspected.
- ☐ b. The downstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The downstream slope appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The downstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Slope protection needs maintenance or repair. Description: _____
- ☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____
- ☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ i. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ g. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☒ h. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ i. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
- ☐ j. The slope was very steep, around a 1 to 1 slope, further study is required to verify slope stability.
- ☐ k. _____

Dam ID: OA-0124

KANEOHE DAM

Inspection No: _____

Date: 4/3/06

8. Abutments/Toe:

Erosion:

☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☒ None Observed

Description: _____

Cracks:

☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☒ None Observed

Description: _____

Vegetation:

☐ None ☒ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees # _____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: _____

Seepage:

Seep Spot Number 1

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed

☒ Flowing, Description: Small seepage area DS right side of outlet works, possible runoff

Water Clarity: ☒ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Seep Spot Number 2

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

- ☐ a. The abutments/toe were not inspected.
- ☒ b. The abutments/toe appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The abutments/toe appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Slope protection needs maintenance or repair. Description: _____
- ☐ f. Rut and/or Gully erosion was observed, which requires maintenance and/or repair. Description: _____
- ☐ g. A crack was observed along the abutments/near the toe, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ h. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ i. Tree(s) were observed along the abutment/toe. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☒ j. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ k. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
- ☐ l. _____

Dam ID: OA-0124

KANEOHE DAM

Inspection No: _____

Date: 4/3/06

9. Outlet Works:

Culvert / Pipe

Type / Size: Box culvert \approx 5x10

Culvert: ☒ Concrete ☐ Masonry ☐ unlined earth ☐ Other _____

Pipe: ☐ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____

Control Type: ☐ Gate ☐ Valve ☒ Other Uncontrolled Drop Structure

Location: ☐ Control on Upstream side ☐ Control on Downstream side

Seepage: ☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☒ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

- ☐ a. The outlet works were not inspected.
- ☐ b. The outlet works were not tested.
- ☒ c. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ d. The outlet works appeared to be in fair to poor condition and requires corrective action.
- ☐ e. The outlet works appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ f. Seepage/Ponding water was observed. Conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
- ☐ g. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area. Failures caused by seepage/piping along the outlet conduit are very common and are considered to be a dangerous situation.
- ☐ h. Were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ i. _____
- ☐ j. _____

Dam ID: OA-0124KANEOHE DAM

Inspection No: _____

Date: 4/3/66**10. Spillway:**

Type:

☐ None ☐ Culvert/Pipe ☒ ChannelDescription: Spillway is grass covered channel to grass + riprap to concrete channel with 06 weirDimension: 50-60 ft @ crest Invert elevation: _____ ft. per staff gageSlope Protection: ☐ None ☐ Grass ☐ Dumped Rock ☒ Fitted Rip Rap ☐ Grouted Rip Rap ☒ Concrete

Defect in Protection: Description: _____

Approach:

☒ Clear ☐ High Veg. ☐ Trees☒ Other: Entrance to spillway has vegetation that should be removed

Erosion:

☐ Scour ☐ Gully ☐ Headcut☒ Not Observed☐ Other: _____

Description: _____

Vegetation:

☐ None ☒ Low Ground Cover ☒ Bushes or Tall Grass ☒ Trees # 3-5 ☐ <6" ☒ >6" & <20" ☐ >20"Description: Trees on the spillway in various areas should be removed.**Findings:**

- ☒ a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ b. The Spillway appeared to be in fair to poor condition and requires corrective action.
- ☐ c. The Spillway appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ d. Slope protection needs maintenance or repair. Description: _____
- ☐ e. The spillway approach was blocked. Clear approach.
- ☐ f. Severe scour erosion was observed which requires maintenance and/or repair.
Description: _____
- ☐ g. A headcut (vertical drop in channel due to erosion) was observed downstream of the spillway. Corrective action is required to prevent this problem from moving upstream.
- ☒ h. Trees are unacceptable in the spillway channel and approach. Take corrective action to address the woody vegetation problem and repair the damaged area.
- ☐ i. Unclear if spillway is adequately sized. Spillway should pass the probable maximum flood. Verify spillway capacity and take corrective action as required.
- ☒ j. Clear vegetation near spillway entrance.

11. Down Stream Channel:Name: Kamooalii StreamDownstream: ☐ Sump ☐ Open Area ☐ Un-Defined Drainage-way ☒ Defined Drainage-way ☐ Other _____Items along Stream Bank: ☐ None ☐ Road ☒ Houses ☐ Town ☒ Not InspectedDescription: as observed from outlet works**Findings:**

- ☒ a. The downstream channel was not inspected.
- ☒ b. The downstream channel appeared to be in satisfactory condition, no corrective actions are required at this time. Near dam outlet work
- ☐ c. The downstream channel appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The downstream channel appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. _____

Dam ID: OA-0124
KANEOHE DAM

Inspection No: _____
Date: 4/3/06

Additional Comments:

On the date of this limited visual inspection, there appeared to be no immediate threat to the safety of the dam. No assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

Limitations and Intent of this Dam Safety Inspection:

This Dam Safety Inspection was conducted to assess the general overall condition of the reservoir/dam, identify visible deficiencies, and recommend areas of for monitoring, additional investigative studies and corrective actions. The inspection is based only on visible features/areas of the dam on the day of inspection. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies. The inspection was conducted under the authority of the Hawaii Revised Statutes Chapter 179D, and Hawaii Administrative Rules, Title 13, Chapter 190, titled "Dams and Reservoirs". Questions regarding this inspection should be forwarded to the Hawaii State Dam Safety Program; PO Box 373; Honolulu, Hawaii 96809; Ph. (808) 587-0236.

Revised: Dec. 1, 2003